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Sudden infant death syndrome

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ABSTRACT

Sudden infant death syndrome (SIDS) is a type of sudden and unexpected infant death, a term that encompasses both deaths from SIDS and ultimately all unexpected infant deaths with a determined cause. 1 Between 27% and 43% of 3500 sudden unexpected infant death cases in the USA annually are due to SIDS. 2, 3 A number of other terms are used in pediatrics to describe sudden and unexpected deaths. Sudden unexpected death of an infant can be used interchangeably with sudden unexpected infant death, and sudden death in youth (ventricular arrhythmias; VAs) refers to such death in any child 19 years of age or younger. Sudden unexplained early neonatal death is limited to infants who die within the first week of life and is usually congenital. anomaly is caused. Sudden intrauterine unexpected death syndrome refers to stillbirths for which postmortem examination cannot identify a cause, and sudden unexpected death in epilepsy is unexpected death in a person with epilepsy (excluding trauma or suffocation) for which postmortem examination does not reveal an anatomical or toxicological cause.

Keywords: Pediatric, sudden infant death syndrome, death

SUDDEN INFANT DEATH SYNDROME

Sudden infant death syndrome (SIDS) is a type of sudden and unexpected infant death, a term that encompasses both deaths from SIDS and ultimately all unexpected infant deaths with a determined cause.[1] Between 27% and 43% of 3500 sudden unexpected infant death cases in the USA annually are due to SIDS.[2,3] A number of other terms are used in pediatrics to describe sudden and unexpected deaths. Sudden unexpected death of an infant can be used interchangeably with sudden unexpected infant death, and ssudden death in youth (ventricular arrhythmias; VAs) refers to such death in any child 19 years of age or younger. Unexplained sudden infant death is usually in the first week of life and is due to a congenital anomaly. Sudden intrauterine unexpected death syndrome refers to stillbirths for which postmortem examination cannot identify a cause, and sudden unexpected death in epilepsy is unexpected death in a person with epilepsy (excluding trauma or suffocation) for which postmortem examination does not reveal an anatomical or toxicological cause.

EPIDEMIOLOGY AND RISK FACTORS

SIDS is the leading cause of death for infants aged 1 month to 1 year. SIDS rates have dropped significantly from 130.3 deaths per 100,000 live births in 1990 to 38.7 deaths per 100,000 live births in 2014 2. This significant decrease is largely attributable to safer sleep practices promoted by the American Academy of Pediatrics “Back Sleep” and “Safe Sleep” campaigns, and to a lesser extent the classification of deaths from asphyxia or sleep drowning separately from SIDS; peaks at 2 to 4 months and is seen in 60% of male infants6. There are ethnic differences, with Asian Americans at lower risk and African Americans and Native Americans at higher risk mothers of SIDS victims are more often under 20 years of age, overweight, unmarried, use drugs, and have few prenatal and postnatal checkups prenatal and postnatal maternal smoking increases the incidence of SIDS. SIDS is more common in the winter months when the baby is awake, with 30-50% signs of acute respiratory tract infection.

Sleep position has received great attention as a modifiable SIDS risk factor. Prone position is associated with an odds ratio of 4.92 for the SIDS. In clinical studies, infants in the prone position have been found to rebreathe exhaled air and experience hypercarbia.[7] Additionally, infants normally dissipate heat from their heads, and prone sleep can prevent heat loss, thereby exacerbating hyperthermia, another risk factor for SIDS.[8] Many babies succumb to SIDS when with a babysitter.[9] Most of these babies are in the prone position. It happens when some babies are first placed in the prone position, and researchers have suggested that these babies have poor strength and tone in their neck muscles. Side sleeping is also considered a risk factor for SIDS and is not recommended. Because of these observations regarding the

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prone position, the American Academy of Pediatrics has recommended supine sleep for normal infants since 1992, and in 2011 published a paper addressing specific sleep-related issues. The supine sleeping position does not increase the risk of aspiration in infants with GI reflux and should also be applied to premature infants, even in neonatal intensive care units, when they are medically stable. Infants should be placed in a cot, bassinet or crib (instead of an adult bed) on a firm mattress and protected from overheating. bed sharing; not recommended especially when baby is under 3 months old, parent smokes, excessively tired or using sedatives (especially alcohol) or using soft surfaces such as sofas or beds with soft mattresses. 4 Prone sleep, bed sharing, sleeping in a place other than a cot or bassinet were associated with 92.2% of SIDS deaths.[10] Sofas are a particularly dangerous sleep environment, generating sleep-related infant mortality.

Swaddling, a common practice to minimize crying and colic, has been shown to increase the risk of SIDS, especially in prone sleepers and especially in babies older than 6 months.[12] High ambient temperature can also contribute.[13] Pacifier use,[14] breastfeeding,[15] and vaccines[16] are protective against SIDS. It has not been shown to prevent SIDS.[17]

If a case does not meet the SIDS criteria, between 1% and 5% of cases of sudden unexpected infant death can be attributed to infanticide.[18] Familial "SIDS" cases increase the possibility of abuse. Traumatic head injuries, bruises, long bone fractures, rib fractures, internal bleeding, evidence of physical neglect or blood around the nose suggest abuse. [19] It is very common for SIDS victims to have a risky sleeping position. A SIDS death without these factors may raise suspicion of abuse. Similarly, channelopathies are a common cause of unexpected sudden infant death that must be excluded before death can be determined to be SIDS.

A registry system has recently been developed to gather accurate and comprehensive information on all sudden deaths in pediatric patients and to better understand the epidemiology and risk factors of both SIDS and sudden unexpected infant death.[20]

PATHOPHYSIOLOGY

Although the exact cause of SIDS is not known, it is thought to be multifaceted. intrathoracic Some autopsy features appear to be relatively consistent among infants succumbing to SIDS, including petechial hemorrhages, thyromegaly, encephalomegaly, microcardia, uncoagulated blood in the heart, kidney growth retardation, empty bladder, and rectum.' The hypothesized mechanism of SIDS, an infant's underlying vulnerability, a critical developmental period, and exogenous includes interaction between stressors— triple risk theory of SIDS. [21]

A genetic basis for infant vulnerability has been studied extensively recently. Although no single genetic locus has been identified for SIDS, the 10-fold increased risk among siblings of SIDS victims suggests a genetic component. Recently, the interleukin-10 gene promoter polymorphism has been associated with SIDS and sudden unexpected death associated with infection. Brain biomarkers ergothioneine, nicotinic acid, succinic acid, adenosine monophosphate and azelaic acid have been associated with SIDS and can predict SIDS. [22] Recent research on the brains of babies who died from SIDS ; medullary, including abnormal firing, synthesis, radiation and clearance shows the presence of serotonergic (5-hydroxytryptamine) pathology[23,24] and morphological differences[25,26] in the brainstem and hippocampus. This likely leads to an inadequate response to hypoxemia. autonomic Dysfunction has also been suggested to play a role.[27]

Infancy may represent a critical period for hypoxia, a possible contributor to SIDS. In general, infants are more likely to have apnea, sustained desaturation, and poor ventilation control. Newborns less than one month old have a better anaerobic capacity to survive and the ability to raise their partial arterial oxygen pressure with one breath. The rarity of SIDS in this age group supports a ventilator theory. Studies looking at babies at various altitudes have found an increased risk of SIDS, especially in children living at altitudes higher than 8,000 ft. [28]

Prenatal and perinatal nicotine exposure can be seen as an example of environmental stressors. nicotine hypercapnia It is hypothesized that it blunts ventilation responses and reduces central respiratory chemoreception by altering the expression of serotonin receptors.[29] The fact that supine sleep significantly reduces the incidence of SIDS suggests that the researchers enabled them to take a closer look at how sleep might affect the autoregulation of respiratory and cardiac centers. Supine sleep is likely to increase sympathetic tone and decrease REM sleep, both thought to reduce the risk of adverse autonomic events.[30,31]

CLINICAL FEATURES

In general, SIDS victims apply in one of two ways: ineligible for restitution or potentially responding to resuscitation measures. If there is no history of environmental hypothermia, rigor mortis, living Infants with a reticularis, PH 46 and significantly reduced core temperature should not be resuscitated. However, warm infants with apnea and no pulse may benefit from resuscitation attempts. of SIDS Regardless of presentation, take a thorough history and perform a complete physical examination. Important questions include a full description of conditions, caregivers, recent illness, prenatal and birth history, maternal and family miscarriage or other infant mortality, and family history of metabolic disease. For epidemiological information, documenting the sleeping position, sleeping location, when and by whom the baby was last seen alive, when and in what position the baby was found, and whether bed-sharing is included, helps the forensic officer. Examination of the infant may not reveal the cause or may show subtle but relevant signs of trauma such as facial bruising, petechiae, blood in the nose or mouth, or a ruptured frenulum that raises suspicion of trauma. rectal temperature and rigor The presence of mortis or bruising will help the forensic examiner determine an approximate time of death.

The families of babies with non-resuscitative SIDS are very emotionally demanding. One of the greatest responsibilities of the physician is to inform, advise and educate the family. The family often wants to spend time with the deceased baby. In general, once death has been declared, the infant's

body should not be manipulated or photographed unless authorized by the forensic officer. If the family wants hand or footprints, inkless pads should be used and this should be documented in the medical record. Do not remove any catheter or tubing inserted during the resuscitation attempt. If the presence of the tube bothers the family, the tubes can be cut from the skin to make it appear less obvious. Unless otherwise directed by the coroner, the family may keep the deceased infant in a private setting, but the family is allowed to spy.

In most jurisdictions, victims of sudden and unexplained deaths should be reported to the coroner as soon as possible. Treating physicians must complete a form notifying death, but not sign the official death certificate, as the cause of death will not be known until after the coroner's investigation is complete. SIDS is technically a post-mortem diagnosis, and sudden unexpected infant death is a more appropriate term for emergency room registration (although not included in the 10th revision of the International Classification of Diseases). If blood samples have been taken, keep the samples in the lab for later access by the forensic officer. Once death is reported, the physician is not authorized to perform postmortem sampling or radiography unless directed by forensic medicine.

Dysfunction associated with a prolonged QT interval or Wolff-Parkinson-White syndrome has been reported in sudden unexpected infant death, 32 autopsies found an accessory atrioventricular tract in 20% of cases of 'SIDS'. Up to %35 abnormal results on post-mortem cardiac canal testing.[33] One If a heart abnormality, particularly a channelopathy, is found, testing of family members can be life-saving, and this is a concrete example to encourage families to emphasize the importance of autopsy.

A home site survey is usually done. Some jurisdictions have infant mortality teams that fully assess the circumstances surrounding the unexpected death of young infants. If the physician believes that the baby is a victim of SIDS, the family should be informed about this, but should be told that the autopsy report is awaited for final confirmation. Involving a primary care provider who can follow up on the autopsy and stay in touch with the family is of paramount importance, The hospital chaplain or social worker can provide additional support and a pastor's counseling may be needed, especially in cases where autopsy laws conflict with the family's religious doctrine prior to the funeral. For infants who need perimortem baptism, this will ideally be done by a pastor, but can also be done by a medical care provider if the pastor is not present. Some states also require reporting to organ procurement agencies.

One of the recurring themes expressed by mothers of SIDS victims when interviewed is self-blame." Eliminating interactions that exacerbate this emotion is an important principle in the treatment of SIDS, while preserving the need for a thorough investigation.

ETHICAL DECLARATIONS

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REFERENCES

1. Berkowitz CD: Sudden infant death syndrome, sudden unexpected infant death, and apparent life-threatening events. *Pediatr Rev 2012;59(1):183.*
2. http://www.cdc.gov/sids/aboutsuidandsids.htm (Centers for Disease Control and Prevention: Sudden unexpected infant death and sudden infant death syndrome.) Accessed at September. 15, 2016
3. Garstang J, Ellis C, Griffiths F, Sidebotham P: Unintentional asphyxia, SIDS, and medically explained deaths: a descriptive study of outcomes of child death review (CDR) investigations following sudden unexpected death in infancy. *Forensic Sci Med Pathol.* 2016;12(4):407.
4. Moon RY. Task Force on Sudden Infant Death Syndrome. SIDS and other sleep-related infant deaths: expansion of recommendations for a safe sleeping environment. *Pediatrics.* 2011;128(5):e1341-1367.
5. Fleming PJ, Blair PS, Pease A. Sudden unexpected death in infancy: aetiology, pathophysiology, epidemiology and prevention in 2015. *Arch Dis Child.* 2015;100(10):984-988. doi:10.1136/archdischild-2014-306424.
6. Goldwater PN. A perspective on SIDS pathogenesis. the hypotheses: plausibility and evidence. *BMC Med.* 2011;9:64. Published 2011 May 27. doi:10.1186/1741-7015-9-64
7. Chiodini BA, Thach BT. Impaired ventilation in infants sleeping facedown: potential significance for sudden infant death syndrome. *J Pediatr.* 1993;123(5):686-692. doi:10.1016/s0022-3476(05)80841-8
8. Iyasu S, Randall LL, Welty TK, et al. Risk factors for sudden infant death syndrome among northern plains Indians [published correction appears in JAMA. 2003 Jan 15;289(3):303]. *JAMA.* 2002;288(21):2717-2723. doi:10.1001/jama.288.21.2717
9. Moon RY, Patel KM, Shaefer SJ. Sudden infant death syndrome in child care settings. *Pediatrics.* 2000;106(2 Pt 1):295-300. doi:10.1542/peds.106.2.295
10. Alexander RT, Radisch D. Sudden infant death syndrome risk factors with regards to sleep position, sleep surface, and co-sleeping. *J Forensic Sci.* 2005;50(1):147-151.
11. Rechtman LR, Colvin JD, Blair PS, Moon RY. Sofas and infant mortality. *Pediatrics.* 2014;134(5):e1293-e1300. doi:10.1542/peds.2014-1543
12. Pease AS, Fleming PJ, Hauck FR, et al. Swaddling and the Risk of Sudden Infant Death Syndrome: A Meta-analysis. *Pediatrics.* 2016;137(6):e20153275. doi:10.1542/peds.2015-3275
13. Auger N, Fraser WD, Smargiassi A, Kosatsky T. Ambient Heat and Sudden Infant Death: A Case-Crossover Study Spanning 30 Years in Montreal, Canada. *Environ Health Perspect.* 2015;123(7):712-716. doi:10.1289/ehp.1307960
14. Nelson AM. A comprehensive review of evidence and current recommendations related to pacifier usage. *J Pediatr Nurs.* 2012;27(6):690-699. doi:10.1016/j.pedn.2012.01.004
15. Young J, Watson K, Ellis L, Raven L. Responding to evidence: breastfeed baby if you can--the sixth public health recommendation to reduce the risk of sudden and unexpected death in infancy. *Breastfeed Rev.* 2012;20(1):7-15.
16. Moon RY, Fu L. Sudden infant death syndrome: an update. *Pediatr Rev.* 2012;33(7):314-320. doi:10.1542/pir.33-7-314
17. Strehle EM, Gray WK, Gopisetti S, Richardson J, McGuire J, Malone S. Can home monitoring reduce mortality in infants at increased risk of sudden infant death syndrome? A systematic review. *Acta Paediatr.* 2012;101(1):8-13. doi:10.1111/j.1651-2227.2011.02464.x
18. Eisenstein EM, Ben-Yehuda Y, Shemesh N, Kharasch S. Investigation of unexplained infant deaths in Israel: time for a different approach. *Isr Med Assoc J.* 2012;14(11):695-699.
19. American Academy of Pediatrics, Hymel KP; Committee on Child Abuse and Neglect; National Association of Medical Examiners. Distinguishing sudden infant death syndrome from child abuse fatalities. *Pediatrics.* 2006;118(1):421-427. doi:10.1542/peds.2006-1245
20. http://www.nhlbi.nih.gov/news/spotlight/fact-sheet/frequently-asked-questions-aboutsudden-death-young-case-registry (National Heart, Lung, and Blood Institute: Frequently asked questions about the sudden death in the young case registry.) Accessed September 22, 2016. [PMID: 28228502]
21. Filiano JJ, Kinney HC. A perspective on neuropathologic findings in victims of the sudden infant death syndrome: the triple-risk model. *Biol Neonate.* 1994;65(3-4):194-197. doi:10.1159/000244052

22. Graham SF, Chevallier OP, Kumar P, Türko Gcaron Lu O, Bahado-Singh RO. Metabolomic profiling of brain from infants who died from Sudden Infant Death Syndrome reveals novel predictive biomarkers. *J Perinatol*. 2017;37(1):91-97. doi:10.1038/jp.2016.139
23. Waters K. Serotonin in the sudden infant death syndrome. *Drug News Perspect*. 2010;23(9):537-548. doi:10.1358/dnp.2010.23.9.1453626
24. Rubens D, Sarnat HB. Sudden infant death syndrome: an update and new perspectives of etiology. Handb Clin Neurol. 2013;112:867-874. doi:10.1016/B978-0-444-52910-7.00008-8
25. Bechtel K. Sudden unexpected infant death: differentiating natural from abusive causes in the emergency department. *Pediatr Emerg Care*. 2012;28(10):1085-1091.
26. Rodriguez ML, McMillan K, Crandall LA, et al. Hippocampal asymmetry and sudden unexpected death in infancy: a case report. *Forensic Sci Med Pathol*. 2012;8(4):441-446.
27. Rand CM, Patwari PP, Carroll MS, Weese-Mayer DE. Congenital central hypoventilation syndrome and sudden infant death syndrome: disorders of autonomic regulation. *Semin Pediatr Neurol*. 2013;20(1):44-55. doi:10.1016/j.spen.2013.01.005
28. Katz D, Shore S, Bandle B, Niermeyer S, Bol KA, Khanna A. Sudden infant death syndrome and residential altitude. *Pediatrics*. 2015;135(6):e1442-e1449.
29. Cerpa VJ, Aylwin Mde L, Beltrán-Castillo S, et al. The Alteration of Neonatal Raphe Neurons by Prenatal-Perinatal Nicotine. Meaning for Sudden Infant Death Syndrome. *Am J Respir Cell Mol Biol*. 2015;53(4):489-499. doi:10.1165/rcmb.2014-0329OC
30. Bergman NJ. Proposal for mechanisms of protection of supine sleep against sudden infant death syndrome: an integrated mechanism review. *Pediatr Res*. 2015;77(1-1):10-19. doi:10.1038/pr.2014.140
31. Rourke KS, Mayer CA, MacFarlane PM. A critical postnatal period of heightened vulnerability to lipopolysaccharide. R*espir Physiol Neurobiol*. 2016;232:26-34. doi:10.1016/j.resp.2016.06.003
32. Schwartz PJ, Stramba-Badiale M, Segantini A, et al. Prolongation of the QT interval and the sudden infant death syndrome. *N Engl J Med*. 1998;338(24):1709-1714.

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